

# Claims

- [c1] 1. A method of processing a run of workpieces, the method comprising the steps of:  
providing a database comprising subgroups of data representing characteristics from previously processed workpieces;  
selecting a first subgroup of data having characteristics that satisfy a predetermined criteria;  
determining processing conditions for a processing tool corresponding to the first subgroup of data;  
processing the run of workpieces with the process tool using the determined processing conditions; and  
measuring the run of workpieces according to a sampling rate determined from the first subgroup of data.
- [c2] 2. The method of claim 1, wherein the characteristics include characteristics of the workpiece.
- [c3] 3. The method of claim 1, wherein the characteristics include characteristics of the process tool.
- [c4] 4. The method of claim 1, wherein the step of selecting a first subgroup of data includes the steps of:  
applying a set of rules to the database such that each

rule generates a unique subgroup of data, wherein the rules are ordered according to a confidence level; and determining a subgroup of data of at least a minimum size that yields a highest confidence level among all of the rules.

- [c5] 5. The method of claim 4, wherein the sampling rate is determined from a capability ratio calculated based on the rule used to generate the first subgroup of data.
- [c6] 6. The method of claim 5, wherein, after processing, the run of workpieces is tagged with the rule used to generate the first subgroup of data.
- [c7] 7. The method of claim 1, wherein the run of workpieces comprises a lot of semiconductor parts and the measuring step comprises a metrology process.
- [c8] 8. An advanced process control (APC) system, comprising:
  - a data analysis system that determines a set of conditions for a manufacturing process based on a subgroup of data identified from a historical database, wherein the subgroup of data is identified according to a selected rule;
  - a tagging system that associates a tag containing the selected rule to each product lot subjected to the manufac-

turing process; and

a sampling optimization system that examines the tag for each product lot processed and determines a metrology sampling rate based on the selected rule.

- [c9] 9. The APC system of claim 8, wherein the selected rule generates a subgroup of data of at least a minimum size that provides a highest possible confidence level for each of a set of rules.
- [c10] 10. The APC system of claim 9, further comprising a rule ordering system that orders the set of rules based on historic capability data for product lots processed with each rule.
- [c11] 11. The APC system of claim 9, further comprising a rule ordering system that orders the set of rules in real time by evaluating capability data for each rule using metrology data.
- [c12] 12. The APC system of claim 8, wherein the sampling rate is determined from a capability ratio  $C_{pk}$  calculated based on the selected rule.
- [c13] 13. The APC system of claim 12, wherein the  $C_{pk}$  is further calculated based on factors selected from the group consisting of: a process tool, a process, technology, part number, level, mask and operation.

- [c14] 14. A method for optimizing metrology sampling rates in an advanced process control (APC) application, comprising:
- calculating capability ratios (Cpk) for a product processed by each of a plurality of rules within a single APC process, wherein each Cpk calculation is based on an associated rule;
  - calculating sampling rates for each calculated Cpk;
  - processing a run of the product using a selected rule;
  - tagging the run of the product after processing with the selected rule; and
  - determining a metrology sampling rate for the run based on the selected rule.
- [c15] 15. The method of claim 14, comprising the further steps of:
- processing a second run of the product using a second selected rule;
  - tagging the second run of the product after processing with the second selected rule; and
  - determining a metrology sampling rate for the second run based on the second selected rule.
- [c16] 16. The method of claim 14, wherein the selected rule is selected from a set of ordered rules that identify subgroups of data from a historical database.

- [c17] 17. The method of claim 16, wherein the selected rule generates a subgroup of at least a minimum size that yields a highest possible confidence level.
- [c18] 18. The method of claim 16, comprising the further step of reordering the set of rules based on historic capability data for product processed with each rule.
- [c19] 19. The method of claim 16, comprising the further step of reordering the set of rules in real time by evaluating capability data for each rule using metrology data.
- [c20] 20. The method of claim 14, wherein the Cpk is further calculated based on factors selected from the group consisting of: a process tool, a process, technology, part number, level, mask and operation.
- [c21] 21. A program product stored on a recordable medium for optimizing an advanced process control (APC) system, comprising:  
means for determining a set of conditions for a manufacturing process based on a subgroup of data identified from a historical database, wherein the subgroup of data is identified according to a selected rule;  
means for associating the determined set of conditions to a product lot subjected to the manufacturing process;  
and

means for examining the associated determined set of conditions for the product lot to determine a metrology sampling rate.

[c22] 22. The program product of claim 21, wherein the associating means includes tagging the selected rule to the product lot.

[c23] 23. The program product of claim 21, wherein the selected rule generates a subgroup of data of at least a minimum size that yields a highest possible confidence level for each of a set of rules.

[c24] 24. The program product of claim 23, further comprising means for ordering the set of rules based on historic capability data for product lots processed with each rule.

[c25] 25. The program product of claim 23, further comprising means for ordering the set of rules in real time by evaluating capability data for each rule using metrology data.

[c26] 26. The program product of claim 21, wherein the sampling rate is determined from a capability ratio  $C_{pk}$  calculated based on the selected rule